COSC130
Computer Organization & Architecture
SYLLABUS

Spring 2019 Course Description
Number systems, Boolean algebra, combinational and sequential circuits, registers, processor functional units and control, pipelining, memory and caching, stored program computing, memory management, computer system organization, and assembly language programming.

Contact Hour Distribution: 3 hours lecture and 1 lab.
Grading Restriction: A, B, C, No Credit grading only.
(RE) Prerequisite(s): 102.
# COSC130

Computer Organization & Architecture

**SYLLABUS**

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I. General Information

1.1. Purpose. This syllabus describes the COSC130 course, policies, and procedures. This syllabus is mandatory for all students enrolled in COSC130.

1.2. Scope. This syllabus applies to all students enrolled in the COSC130 course at the Min H. Kao Department of Electrical Engineering and Computer Science (http://www.eecs.utk.edu) of the Tickle College of Engineering (http://tickle.utk.edu) of the University of Tennessee (http://www.utk.edu).

1.3. Amendments. Amendments may be made to this syllabus with or without notification; therefore, do NOT save this syllabus. Instead, retrieve it from Canvas every time in case it happens to update. Use the date at the lower-right corner of the syllabus to determine if you’re reading the most up-to-date version. A summary of changes will be provided on the syllabus.

1.3.1. Exceptions. Topics, office hours, and TAs may be updated without additional approval this syllabus.

1.4. Current Version. The most current version of this syllabus may be downloaded at: http://tiny.utk.edu/cosc130.

1.5. Key Words.

1.5.1. "Will", "must", and "shall" indicate a mandatory requirement.

1.5.2. "Should" is used to indicate a preferred, but not mandatory, method.

1.5.3. "May" indicates an acceptable or suggested means.

1.5.4. “UTK” is short for the “University of Tennessee at Knoxville”.

1.5.5. “TBD” is short for “To Be Determined”.

1.5.6. “IAW” is short for “In Accordance With”.

1.6. Learning Management System. All students will be required to use Canvas as the learning management system. COSC130 for the Spring 2019 semester is at: https://tiny.utk.edu/canvas_cosc130.

1.6.1. Calendar. The Canvas calendar will be used to notify any class cancellations for any purpose, including holidays. Students will be required to frequently check their Canvas calendar for due dates and class dates.

1.7. Times and Dates. All times and dates, including due dates, will use the Eastern Time Zone and will observe spring and fall time changes (EST and EDT). Furthermore, all times will use a 24-hour clock (e.g., 1100 = 11:00am, 1200 = 12:00pm, 1500 = 3:00pm, 1800 = 6:00pm, 2200 = 10:00pm, etc.).

1.8. Student Information and Accommodations. All student information will be kept confidential in accordance with the Family Educational Rights and Privacy Act of 1974 (FERPA). More information may be found at: https://ferpa.utk.edu.
1.8.1. **FERPA Waiver.** Students may waive some or all their FERPA rights, typically in cases such as letters of recommendations. Students must complete and sign a FERPA form before any FERPA-related information is released.

1.8.2. **Disclosure.** All student information is covered under FERPA and will not be disclosed to anyone, including students' parents. FERPA information necessary for this course is retrievable by the professors, undergraduate teaching assistants, and graduate teaching assistants.

1.8.3. **Disability.** Any students who have disabilities may register with the Office of Student Disability Services (SDS) for a range of accommodations. No accommodations will be made without prior approval from SDS.

1.8.3.1. **SDS Website.** More information about SDS may be found at: [https://sds.utk.edu](https://sds.utk.edu).

1.9. **Deviations.**

1.9.1. While compliance with this syllabus is mandatory, the following exceptions to policy may be made given:

1.9.1.1. All exception to policy rules must be in writing (unless otherwise noted), or
1.9.1.2. Exceptions to policy rules must be made at the department head level, or
1.9.1.3. Any illness, injury, death in the family, and so forth requires an "absence request" from the Dean of Students ([https://dos.utk.edu](https://dos.utk.edu)).

1.9.2. For unusual circumstances, the professor or instructor may deviate from this syllabus on a case-by-case basis.

1.9.2.1. TAs and other representatives of this course may suggest deviations, but they are not permitted to approve deviations and must comply with 1.9.1 above.

1.10. **Teaching Assistants (TA).** Teaching assistants are representatives of the COSC130 professors. They have full access to all student information, including grades. Teaching assistants may be undergraduate (UTA) or graduate students (GTA), or both.

1.11. **Supplemental Instructors (SI).** Supplemental instructors from the student success center are not official representatives of the COSC130 course.

1.11.1. Students will not consider any instruction or suggestion to be official from any supplemental instructor.

1.11.2. Supplemental instructors must not make any deviations per section 1.9 of this syllabus.

1.11.3. Information about the SI program is available at: [https://studentsuccess.utk.edu/supplemental-instruction/what-is-supplemental-instruction](https://studentsuccess.utk.edu/supplemental-instruction/what-is-supplemental-instruction).

1.12. **Contacts.** Electronic communications will be made to the professor and teaching assistants through Piazza. A link is provided on Canvas to connect to Piazza.
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1.12.1. **Email Correspondence.** For most purposes, do NOT email a teaching assistant of professor directly. These emails are likely to be ignored.

1.13. **Letters of Recommendations.** Letters of recommendations will generally not be written for COSC130 students. Exceptions to this policy may be made by the professor on a case-by-case basis.

1.13.1. **FERPA Requirements.** Any letter of recommendation written must have a FERPA waiver on file with the professor writing the letter.
II. Office Hours

1.1. Office Hours. The teaching assistants will hold regular office hours to assist students with the course material and with their lab assignments.

1.1.1. Information. Information including times and locations will be posted to Canvas.

1.1.2. Rules for Help. The teaching assistants have been instructed NOT to give answers but try to lead you to answers or show you where the information can be found. The teaching assistants may point you to a place to read information rather than tell you the information outright.

1.2. Programming Clinic Conduct. Students will conduct themselves with respect towards those holding the office hours. The programming clinic tends to get very busy, and the teaching assistants will try to give time to each student requesting help.

1.2.1.1. Availability. Students will not congregate in Min Kao Room 416. Instead, students will enter the room, ask their question(s), and then leave. The room is too small to allow students to stay. The teaching assistants may ask that any student who is in the programming clinic leave until they have a question, regardless of the number of students in the room.

1.2.1.2. Behavior Penalties. Students who do not follow the rules laid out above may be sanctioned in accordance with UT HillTopics Student Code of Conduct: https://hilltopics.utk.edu/student-code-of-conduct.
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III. Course Work


1.2. Assignments. Students will be assigned and graded based on a variety of assignments.

1.2.1. Submissions. All assignments will be submitted to Canvas. Submissions sent via Piazza or email to a professor or teaching assistant will be ignored.

1.2.2. Homework. Students will complete homework assigned using Canvas.

1.2.3. Labs. Weekly labs will be assigned on Canvas. All submissions must be made through Canvas (see Figure 1).

![Figure 1: Submitting Lab Assignments](image)

1.2.3.1. Lab Attendance. Students must attend their registered lab sections. Unless given specific permission, students will NOT attend a lab section for which they are not registered.

1.2.3.2. Lab Submission. Students must submit their labs using Canvas.

1.2.3.2.1. Diligence. Students must check their submission to ensure it is the correct submission and that it properly submitted. NO EXCEPTIONS will be made for incorrect submissions.

1.2.3.2.2. Recency. Only your latest submission will be graded. If you previously submitted your lab prior to the due date and subsequently submitted past the due date, the lab submitted past the due date will be graded and subject to late penalties.

1.2.3.2.3. Comments. Students may make comments on their submission; however, these have no bearing on the students’ grading. Graders are NOT given notification when a student makes a comment. Therefore, students will not make comments after the assignment has been graded.
1.2.3.3. **Lab Solutions.** Lab solutions will not be distributed. See your teaching assistant for questions about any of your lab submissions.

1.2.4. **Class Participation.** Class participation will be graded using TurningPoint "clickers". See: [https://www.turningtechnologies.com/turningpoint](https://www.turningtechnologies.com/turningpoint).

1.2.4.1. **Registration.** Students must use the provided link on Canvas to register their clicker for the course. Unregistered clickers cannot be graded.

1.2.4.2. **Clicker Access.** Physical, mobile, and/or online clickers may be used in class.

1.2.4.2.1. **Switching Response Devices.** Students must not switch clicker devices during a class session. However, students may switch devices between sessions (e.g., between Tuesday's and Thursday's classes).

1.2.5. **Exams.** Students will complete exams on Canvas during their lab period, unless otherwise noted. The final exam will be given during the sanctioned final exam period and will be a written, paper exam in the classroom (Min Kao Room 622).

1.2.5.1. **Missing Exams.** Students must notify their professor in writing that they will miss an exam at least one (1) week prior to the exam. Approved missed exams must be taken as soon as possible. Note that make-up exams may or may not be taken in the same place as the original exam.

1.2.5.2. **Disability Services.** Students who need extra time for an exam must take the exam at the Student Disability Services Testing Center (SDS) (see: [https://sds.utk.edu/testing-center](https://sds.utk.edu/testing-center)). Disability services will be provided a hard-copy version of the exam and will email the completed exam to the professor.

1.2.5.3. **Make-up Exams.** Make-up exams will only be offered to those who are excused from the original time or place. To avoid potential cheating, make-up exams may or may not be the original exam.

1.2.5.3.1. **Excused Exams.** For some circumstances, such as a long break, an exam may be excused completely, and no make-up exam will be offered. These exams will neither count for nor count against your grade.

1.3. **Due Dates.** All due dates will be listed on Canvas.

1.3.1. **Diligence.** Students are responsible to check Canvas regularly for any due dates.

1.4. **Late Policy.** Students may submit assignments up to three (3) days late.

1.4.1. **Penalty.** Late assignments will be penalized 3% per hour it is submitted past the due date. The penalty is automatically applied by Canvas.

1.5. **Grading.**

1.5.1. **Weights.** The weight of each grading category is listed on Canvas under “Syllabus”.
1.5.2. **Canvas.** Students must make sure that the checkbox shown in Figure 2 is *unchecked*. Otherwise, assignments not submitted will not count against the student's grade.

![Canvas Grading Checkbox](image)

**Figure 2: Canvas Grading Checkbox**

1.5.3. **Homework.** Homework is automatically graded by Canvas.

1.5.3.1. **Attempts.** You will have an unlimited number of attempts at the homework until the due date passes. Your highest score will be recorded for your homework grade. Finally, you will have a waiting period between attempts.

1.5.4. **Labs.** Teaching assistants will typically grade lab submissions.

1.5.4.1. **Comments and Formatting.** All student lab submissions must be properly formatted and commented, including a commented header which includes the student’s name, date, and a summary of the lab.

1.5.4.2. **Compiling Requirement.** Unless otherwise noted, all labs that do not compile on the EECS-IT lab machines (i.e., Tesla, Hydra, and Arc lab machines) using the given compiling commands will be graded 0.

1.5.4.2.1. **Appeals.** Students will not appeal a 0-grade due to compiling problems.

1.5.5. **Appeals.** Students may appeal the grade they received on any assignment. Students must use Piazza and put in writing their intention to appeal a grade. The Piazza message must be sent to all "Instructors".

1.5.5.1. **Timeliness.** Appeals must be made within ten (10) days of receiving the grade.

1.5.5.2. **Regrading.** A TA may regrade a student’s work without regard to their previous grade. Therefore, the student may receive a lower grade after an appeal.

1.6. **Grade Curving.** Grades will not be curved or rounded. Grades will not be "bumped" to another grade level no matter how close it is.

1.7. **Extra Credit.** Several opportunities may be given to earn extra credit.

1.7.1. **End of Course Survey.** An end of course survey will be offered. This course survey will permit a student to earn extra points towards their final grade. This is used in lieu of curving and rounding grades.

1.7.1.1. **Survey Credit.** The amount of extra credit given for the end of course survey will be indicated on Canvas.
1.8. Workload Recommendation. COSC130 requires a significant amount of weekly work to succeed. As such, students should not take more than 16 semester credit hours (including COSC130).

1.9. Official University Appeal. A student may appeal their final grade with the University of Tennessee. The procedures for doing so are outlined at: [http://catalog.utk.edu/content.php?catoid=24&navoid=3078#grad аппел proc](http://catalog.utk.edu/content.php?catoid=24&navoid=3078#grad аппел proc).
IV. Code of Conduct

1.1. **Honor Statement.** Students will conduct themselves according to the University of Tennessee Hilltopics Honor Statement, which may be viewed at: http://catalog.utk.edu/content.php?catoid=24&navoid=3078#hono_stat.

1.2. **Behavior.** Any student who exhibits inappropriate behavior may be admonished immediately and/or referred to student conduct (see section 1.3.3.5 below). Continued inappropriate behavior may involve the University of Tennessee Police Department (UTPD).

1.3. **Plagiarism and Cheating.** Any student who is suspected of plagiarism and/or cheating will receive a penalty for doing so. The student will not be notified in advanced at the penalty or that they were suspected of violating the plagiarism and/or cheating policy. Instead, it is the student’s responsibility for contacting their professor.

1.3.1. **Examples of Cheating.** Plagiarism and cheating may result from a student copying an assignment or sections of an assignment from another student, from an online source, or from the student’s own previous assignment (from a previous attempt at the course).

1.3.2. **Working Together.** Students are encouraged to work together, however this increases the risk of plagiarism and/or cheating. Students are cautioned to make sure that when they work together that their code cannot be seen by another student. We recommend that students work together by placing their laptops back to back. With this method, students may discuss topics, but the code they write is purely their own.

1.3.2.1. **Citation.** Always cite any professor, teaching assistant, or another student with whom you discussed the work with. Even if you cannot see another student’s code, the chances of parallel thinking are increased. When you cite whom you worked with, we can understand where your lab may look like another.

1.3.2.1.1. **Parallel Thinking.** Citations do NOT preclude you from abiding by the plagiarism/cheating policy. Even if you cite your source, you may still not copy code in portions or entirety.

1.3.3. **Penalties.** The professors and teaching assistants are not investigation units. Therefore, anyone found in violation of the plagiarism policy will receive the same penalty regardless of who originated the content.

1.3.3.1. **Labs/Homework.** Students will receive a 0 for the lab or homework and a ten (10) point drop on their final grade. This will appear as a “Plagiarism” column on Canvas. Essentially, it removes exam points to achieve a 10-point drop on the student’s final grade.

1.3.3.1.1. **Repeated Violations.** Repeated violations of the plagiarism or cheating policy will result in a 0 for the course.

1.3.3.2. **Exams.** Any suspected plagiarism and/or cheating on an exam will result in a 0 for the course.
1.3.3.3. **Stolen Work.** If an allegation of theft is made, the theft will immediately be reported to student conduct for an investigation.

1.3.3.4. **Extended Scrutiny.** After a student has been flagged for potential plagiarism, all other works will be more closely scrutinized for plagiarism, past and present. Students will note that if they have not been caught for plagiarism, it doesn’t mean it’s not plagiarism. Therefore, if a previous work was plagiarized, the student or students responsible will be held to account for multiple violations of the plagiarism policy.

1.3.3.5. **Referrals.** The professors and teaching assistants reserve the right to refer any student behavior to student conduct regardless of previous incidents, or lack thereof. More information about referrals and student conduct may be found at: [https://studentconduct.utk.edu](https://studentconduct.utk.edu).
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V. Transcript Grades

1.1. Letter Grades. Numeric grades will follow Table 1 to translate to the final letter grade.

1.2. No Credit. Students who earn below a C will receive a grade of NC (No Credit). Information about the NC grading may be found in the University of Tennessee Catalog: http://catalog.utk.edu/content.php?catoid=24&navoid=3078#ABC_NC_grading

<table>
<thead>
<tr>
<th>Letter</th>
<th>Floor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94</td>
</tr>
<tr>
<td>A-</td>
<td>90</td>
</tr>
<tr>
<td>B+</td>
<td>87</td>
</tr>
<tr>
<td>B</td>
<td>84</td>
</tr>
<tr>
<td>B-</td>
<td>80</td>
</tr>
<tr>
<td>C+</td>
<td>77</td>
</tr>
<tr>
<td>C</td>
<td>75</td>
</tr>
<tr>
<td>NC</td>
<td>0</td>
</tr>
</tbody>
</table>

*Table 1: Letter Grade Conversion*
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VI. Schedule

1.1. Dates. All key dates will be listed on the course calendar on Canvas.

1.2. Attendance. Attending all lectures and labs is mandatory.

1.3. Lecture. Lectures will be held on Tuesdays and Thursdays in Min Kao Room 622 (large auditorium) and are 75 minutes. Lecture begins at 1540 and ends at 1655.

1.3.1. Instructor. A teaching assistant or another professor may substitute for a class, or a class may be canceled if the primary instructor is unable to teach for any reason, such as due to an illness.

1.4. Labs. All lab periods are on Fridays in Min Kao Room 421 (Hydra Lab) and are 1 hour and 55 minutes in duration. Refer to Table 2 for your lab section starting and ending times and teaching assistant.

<table>
<thead>
<tr>
<th>Section</th>
<th>Starts</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>0800</td>
<td>0955</td>
</tr>
<tr>
<td>002</td>
<td>1010</td>
<td>1205</td>
</tr>
<tr>
<td>003</td>
<td>1220</td>
<td>1415</td>
</tr>
<tr>
<td>004</td>
<td>1430</td>
<td>1625</td>
</tr>
<tr>
<td>005</td>
<td>1640</td>
<td>1835</td>
</tr>
</tbody>
</table>

*Table 2: Friday Lab Sections*
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VII. Weekly Topics

1.1. Spring 2019. The weekly course schedule, Table 3, describes the topics that will be covered during the spring 2019 semester.

1.1.1. Date. The date refers to the first day of the week that the topics will be covered.

1.2. Changes. Changes to the schedule may be made with or without notice.

<table>
<thead>
<tr>
<th>Week</th>
<th>Begins</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>01/09</td>
<td>Introduction, number systems</td>
</tr>
<tr>
<td>02</td>
<td>01/15</td>
<td>Bitwise operators</td>
</tr>
<tr>
<td>03</td>
<td>01/22</td>
<td>Binary arithmetic</td>
</tr>
<tr>
<td>04</td>
<td>01/29</td>
<td>Floating point</td>
</tr>
<tr>
<td>05</td>
<td>02/05</td>
<td>Pointers and dynamic memory</td>
</tr>
<tr>
<td>06</td>
<td>02/12</td>
<td>Binary files</td>
</tr>
<tr>
<td>07</td>
<td>02/19</td>
<td>RISC-V assembly, branching, functions</td>
</tr>
<tr>
<td>08</td>
<td>02/26</td>
<td>Assembly structures, encoding</td>
</tr>
<tr>
<td>09</td>
<td>03/05</td>
<td>Advanced assembly, decoding</td>
</tr>
<tr>
<td>10</td>
<td>03/12</td>
<td>Review</td>
</tr>
<tr>
<td>11</td>
<td>03/19</td>
<td>Spring break (NO CLASS)</td>
</tr>
<tr>
<td>12</td>
<td>03/26</td>
<td>Combinational logic, truth tables, circuits</td>
</tr>
<tr>
<td>13</td>
<td>04/02</td>
<td>Sequential logic, state machines</td>
</tr>
<tr>
<td>14</td>
<td>04/09</td>
<td>Boolean algebra, K-maps</td>
</tr>
<tr>
<td>15</td>
<td>04/16</td>
<td>Paging, cache</td>
</tr>
<tr>
<td>16</td>
<td>04/23</td>
<td>Pipelining</td>
</tr>
</tbody>
</table>

Table 3: Weekly Topics
VIII. Learning Objectives
At the conclusion of this course, successful students should be able to accomplish or understand the following:

Number Systems and Bases
1. Understand how hexadecimal, binary, and decimal interoperate.
2. Convert between different number bases.
3. Understand why hexadecimal and binary are widely used in computing.

Binary Arithmetic
1. Understand how an arithmetic logic unit works.
2. Perform basic arithmetic with numbers of varying bases.
3. Understand how a computer performs the same basic arithmetic.

Computer Architecture / Assembly
1. Understand how memory is allocated/deallocated on the stack, heap, and data sections.
2. Understand how executable programs are formatted.
3. Be able to create a basic assembly program.
4. Understand how high-level languages abstract different programming aspects.
5. Appreciate high-level languages, such as C++.
6. Understand how parameters and return data is used in assembly.
7. Understand hierarchies of memory, such as registers, RAM, and mass storage.

Computer Organization
1. Understand the benefits of pipelining.
2. Understand why pipelining improves CPU performance.
3. Understand the hazards associated with pipelining.
4. Understand how cache improves memory performance.
5. Understand the different cache techniques, including direct-mapped, set-associative, and fully associative techniques.
6. Understand how cache units are evicted and what techniques are used to determine eviction.

Digital Logic
1. Understand rudimentary logic gates, such as AND, OR, XOR, and NOT.
2. Be able to design a digital logic circuit to accomplish a basic task, such as addition.
3. Understand combinational and sequential logic.
4. Be able to reduce circuits using Boolean algebra and Karnaugh maps.
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IX. Summary of Changes
26-Mar-2019: Changes to weekly topics.
31-Jan-2019: Changes to weekly topics. Removed week 6 and moved up all other weeks.
10-Jan-2019: Changes to weekly topics. Harris book is required.
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X. Approval

Stephen Gregory Marz
Dr. Stephen Marz
Lecturer